PALEONTOLOGY.—*Notes on* Phanocrinus cylindricus *and description of new species of Chester crinoids.* Harrell L. Strimple, Bartlesville, Okla. (Communicated by Alfred R. Loeblich, Jr.)

In this paper I present notes on the Fayetteville formation manifestation of *Phanocrinus cylindricus* and describe the following new species of Chester crinoids: *Eupachycrinus modernus, Aphelecrinus planus, Aphelecrinus exoticus,* and *Scytalocrinus aftonensis.*

Genus **Phanocrinus** Kirk, 1937

Phanocrinus cylindricus Miller and Gurley
Fig. 11

The species was well defined by Miller and Gurley (1894) and is readily distinguished from other described species by the full deep calyx and the 10 long, slow-tapering, uniserial arms. The surface of the dorsal cup was said to be granular. Horizon was given as "Kaskaskia group," of Pulaski County, Ky.

Kirk (1937) referred the species to *Phanocrinus* and has been followed by Sutton and Hagan (1939) and Sutton and Winkler (1940). The later authors described and figured a specimen of the Walker Museum collection as a syntype from the "Chester series of Pulaski County, Kentucky." They specified that no granulations were present.

Bassler and Moodey (1943) gave a more specific horizon for the species as "Chester-Glen Dean" but did not give a more specific locality.

The author considers it a matter worth recording that specimens readily identified as *P. cylindricus* have been collected from the Fayetteville formation, Chester, of Craig County, Okla., which decidedly show not only granulations on the surface of the cup plates, but also along the lateral sides of the axillary first primibrachials and the first secundibrachials. On the dorsal cup, granules are more prevalent on the RR and plates of the posterior interradius than elsewhere. On occasions the granules tend to become confluent and form irregular shaped narrow ridges. Apparently weathering, or possibly rolling about on the bottom of the ancient ocean, or both, had a tendency to obliterate the granulations except where protected along the impressed sutures and the lateral sides of the brachials. In many instances the granulations are difficult to discern except with the aid of low-powered magnification.

Two well-preserved crowns of *P. cylindricus* from the Fayetteville formation of northeastern Oklahoma are being deposited in the U. S. National Museum. The figured specimen was collected by Claude Bronaugh, of Afton, Okla.

Genus **Eupachycrinus** Meek and Worthen, 1865

Eupachycrinus modernus, n. sp.
Figs. 6–8

Dorsal cup is bowl-shaped, with broad basal concavity. Five small IBB are almost entirely covered by the large proximal columnal, but the triangular shaped extremities are visible. Five large BB form a good portion of the cup walls and curve sharply under to form also the sides of the basal invagination. Five large RR are slightly wider than long. Three large anal plates are present in the broad, mildly protruded posterior interradius. Anal X is hexagonal, with lower edge in broad contact with the truncated upper extremity of post. B. RA is pentagonal and lies obliquely on the right shoulder of post. B and a left facet of r. post. B. The hexagonal RX is directly above RA and to the right of anal X. All cup plates are tumid and are devoid of ornamentation.

First primibrachials are wide, axillary in all rays and fill the upper faces of RR. A second bifurcation takes place with the first secundibrachials in the anterior rays of the l. post. and r. ant. rami and in the posterior ray of the r. post. ramus. Both the left anterior and anterior rays have only two arms. In proximal portions of the arms the arrangement is uniserial but quickly becomes biserial. Delicate pinnules are present.

The proximal columnal has a mildly pentagonal outline and is pierced by a small pentalobate lumen. The anal sac is partially exposed and is small, round, composed of thin hexagonal plates, probably five to a circlet.

Measurements in mm.—As follows:

	Holotype
Height of dorsal cup	6.0
Maximum width of cup	13.5
Length of l. post. B	7.7[1]
Width of l. post. B	6.2[1]
Length of interbasal suture	4.7[1]
Length of l. ant. R	4.6[1]
Width of l. ant. R	7.0[1]
Length of interradial suture	2.7
Diameter of proximal columnal	3.2

[1] Measurements taken along normal curvature of plates.

Remarks.—This species is different from normal representatives of the genus as interpreted by Kirk (1937) in several respects. Typical species have a second bifurcation of the arms in the right and left anterior rays, and in the anterior radius only two arms are developed. In *E. modernus* the second bifuraction is in the posterior ray and the left anterior radius is restricted to two arms. Another characteristic of normal *Eupachycrinus* is the unusual height of the basal concavity and a weakness of IBB plates disclosed by their normal absence. In the present species IBB are in place, albeit almost entirely covered by the proximal columnal, and the inner height of BB is 1.5 mm. lower than their outer height.

Occurrence and horizon.—Unnamed limestone formation below the Fayetteville formation, Chester, Mississippian; railroad cut about 3 miles southwest of Locust Grove, Okla.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

Genus **Aphelecrinus** Kirk, 1944

Aphelecrinus planus, n. sp.
Figs. 9–11

Dorsal cup is low cone-shaped. The holotype is slightly distorted by lateral compression. Five IBB extend only slightly beyond the large, round columnar scar, and are upflared. Five BB are large and form a good portion of the calyx walls. They have a pentagonal outline but actually possess six sides with the exception of the posterior and right posterior which each have an extra facet for contact with plates of the anal interradius. Five RR are distinctive pieces. Outwardly directed articulating facets do not fill the width of RR and the outer faces of RR are extended along the interradial sutures to the innermost extremities of the plates. Posterior interradius is composed of three plates in normal (primitive) arrangement. All cup plates are unornamented.

There is an isotomous division of the long, slender arms in all rays on the somewhat elongate first primibrachials. Another bifurcation is known to occur in some rays at a considerable distance from the cup. Nonaxillary brachials are alternatingly extended as short spines so that one lateral side of each brachial is long and carries a stout pinnule, and the opposite side of the succeeding brachial is elongate and pinnular bearing.

Tegmen has not been observed.

Measurements in mm.—As follows:

	Holotype
Length of crown	55.5
Height of dorsal cup	4.3
Maximum width of cup	10.7[1]
Diameter of columnar scar	2.4
Height of l. post. B	3.1
Width of l. post. B	3.2
Length of interbasal suture	1.7
Height of l. ant. R	2.7
Width of l. ant. R	4.2
Height of l. ant. PBr	4.9
Width of l. ant. PBr	4.0

[1] Distorted.

Remarks.—*A. planus* appears to be more closely related to *A. limatus* Kirk (1944) than other described species. The latter is a smaller species, with more exposed IBB plates, less ornate arm structure and less pronounced indentation of the interradial areas in the upper extremity of the cup.

Occurrence and horizon.—Approximately 5 miles southwest of Afton, Okla.; Fayetteville formation, Chester, Mississippian.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

Aphelecrinus exoticus, n. sp.
Fig. 5

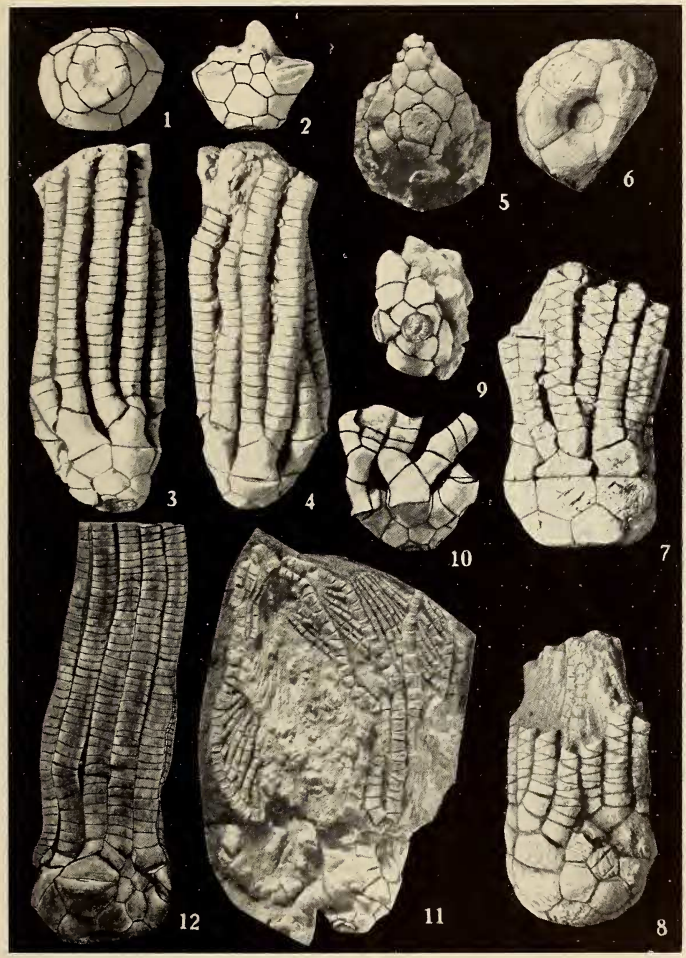
Dorsal cup is shallow, cone-shaped. Five IBB extend slightly beyond the large, round columnar scar and are upflared in attitude. Five BB are of modest size. Five RR are rather large. Articular facets are directed outwardly and fail to fill the distal faces of RR. Lateral sides of RR are curved sharply inward and recurve to form a flat narrow surface along the interradial sutures, which surface continues into the interarticular areas. Outer ligamental areas are strongly impressed, transverse ridges are prominent and intermuscular notch is pronounced. The muscle scars are shallow, lacking in definition. Three anal plates occupy the broad, protruded posterior interradius. Arrangement of these plates is normal (primitive) and RA is the most prominent. A small but well defined depression occurs at the proximal tip of each RR and extends into the interbasal areas. All cup plates are covered with narrow, irregular, elongated ridges or pustules.

Arms and tegmen have not been observed.

Measurements in mm.—As follows:

	Holotype
Height of cup	2.5 (distorted)
Width of dorsal cup (right post. anterior to left anterior radius)	11.7
Height of l. post. B	2.5
Width of l. post. B	3.0
Height of l. post. R	2.7[1]
Width of l. post. R	4.6
Width of articulating facet	3.6
Diameter of columnar scar	2.2

[1] To outer lip of ligamental furrow.



Figs. 1–4.—*Scytalocrinus aftonensis*, n. sp.: 1, 2, Paratype from basal and posterior; 3, 4, holotype from right posterior and anterior, × 2. Fig. 5.—*Aphelecrinus exoticus*, n. sp.: Holotype from base, × 1.8. Figs. 6–8.—*Eupachycrinus modernus*, n. sp.: Holotype from base, anterior and posterior, × 2. Figs. 9–11.—*Aphelecrinus planus*, n. sp.: Holotype from base and anterior (Figs. 9 and 10 are enlarged × 1.8 and have been separated from the distal portions of the arms; Fig. 11 is × 1.4, showing the entire specimen). Fig. 12.—*Phanocrinus cylindricus* (Miller and Gurley): Left posterior view of specimen from the Fayetteville formation, × 1.8.

Remarks.—*A. exoticus* differs from other described species in the unusual depression of interradial sutures, dimplelike depressions at the proximal extremities of RR and in having spectacular ornamentation of cup plates.

Occurrence and horizon.—Approximately 5 miles southwest of Afton, Okla.; Fayetteville formation, Chester, Mississippian.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

Genus **Scytalocrinus** Wachsmuth and Springer, 1880

Scytalocrinus aftonensis, n. sp.
Figs. 1–4

The crown is slender, long, and compact. Dorsal cup is truncate cone-shaped. Five IBB form a subhorizontal plane about the columnar scar with distal extremities curved upward to slightly participate in lateral walls of the cup. Five BB are wide, hexagonal except for posterior and right posterior BB, which each have an extra facet for contact with anal plates. Five RR are wide, pentagonal plates with subhorizontal articulating facets filling their distal faces. Outer ligamental notches are deep and wide. Transverse ridges are well defined and the muscle scars are moderately deep. Adsutural slopes are steep. The posterior interradius is rather narrow and the three relatively small anal plates are in normal (primitive) arrangement.

There are 10 cuneiform arms branching isotomously with the first primibrachial in all rays. The surfaces of the arms are well rounded, and there is no sharp angulation between the outer areas and the lateral sides. Each secundibrachial bears a pinnule.

The columnar scar is circular in outline, slopes strongly to the lumen and is heavily crenulated. The lumen appears to be pentalobate. The entire crown is devoid of ornamentation.

Measurements in mm.—As follows:

	Paratype	*Holotype*
Height of dorsal cup	6.5	4.5
Maximum width of cup	11.6	8.7
Height of l. post. B	2.8	2.5
Width of l. post. B	3.5	2.8
Length of interbasal suture	1.6	1.5
Height of l. ant. R	3.1	2.8
Width of l. ant. R	6.0	4.2
Length of interradial suture	2.2	2.0
Diameter of columnar scar	2.8	2.8

Remarks.—*S. aftonensis* is most readily separable from other described species in the nature of the IBB plates, which form a subhorizontal platform about the concave columnar scar, then flex sharply upward in distal portions to participate in the lateral calyx walls.

S. validus, the genotype species, has IBB that do not participate in the lateral cup walls and often the anterior ramus fails to bifurcate.

Hypselocrinus Kirk (1940) has upflared IBB, but they rise directly from the columnar scar. In the shape of the cup, therefore, the Fayetteville species appears to occupy an intermediate position between the two genera.

The irregular length of the axillary PBrBr is comparable to that found in *Apographiocrinus typicalis* Moore and Plummer as presented by the author (1938) under the name *Graphiocrinus carbonarius.* The height of these plates in mm is: l. ant. 3.8, l. post. 4.3, ant. 4.7, r. ant. 3.5, and r. post. 4.6.

Occurrence and horizon.—Approximately 5 miles southwest of Afton, Okla.; Fayetteville formation, Chester, Mississippian.

Types.—Collected by Mrs. Hazel Bronaugh, of Afton, Okla. To be deposited in the U. S. National Museum.

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